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(54) **METHOD AND APPARATUS FOR TRANSMISSION FRAMING IN A WIRELESS COMMUNICATION SYSTEM**

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See application file for complete search history.

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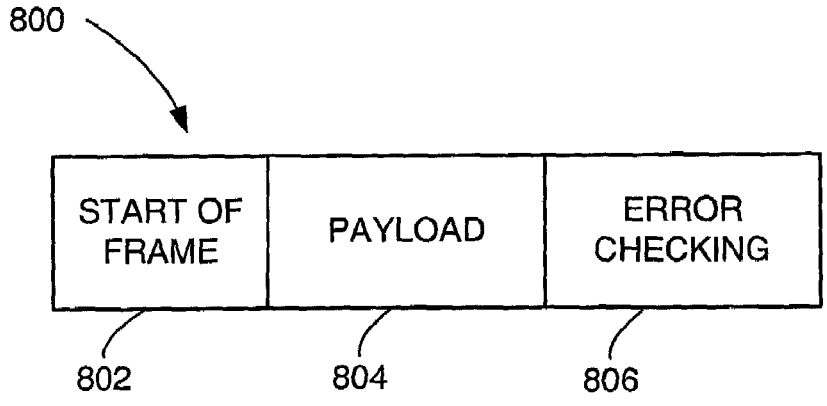
(57) **ABSTRACT**

Method and apparatus for framing in a wireless transmission system supporting broadcast transmissions. A framing format incorporates fields specific to a uni-directional transmission and reduces the overhead of the system. One embodiment employs a version of HDLC having a start of frame field and an error checking mechanism attached to the payload of each frame, wherein protocol information is not transmitted with each individual frame.

22 Claims, 13 Drawing Sheets



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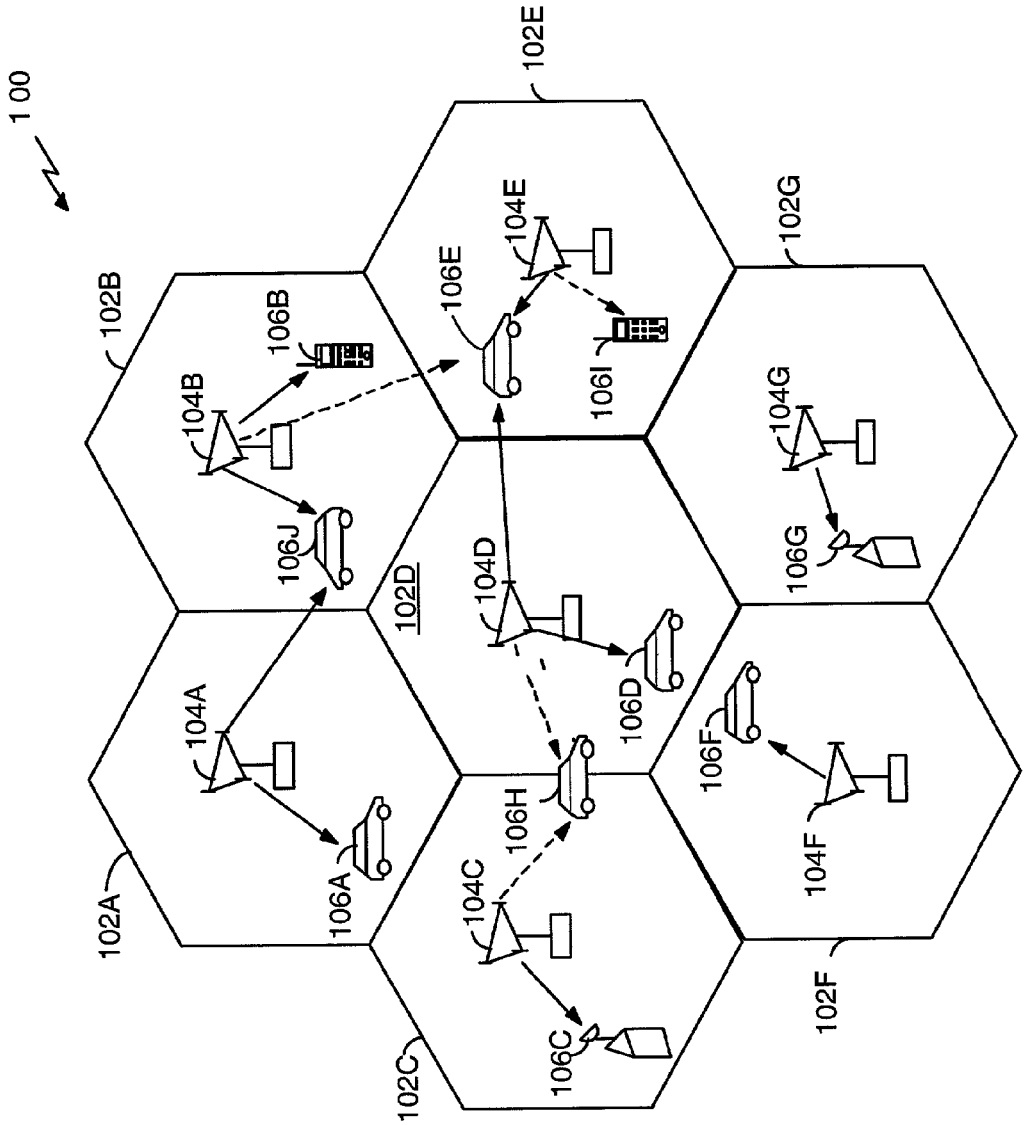
100
102A
102B
102C
102D
102E
102F
102G
104A
104B
104C
104D
104E
104F
104G
106A
106B
106C
106D
106E
106F
106G
106H
106I
106J

FIG. 1

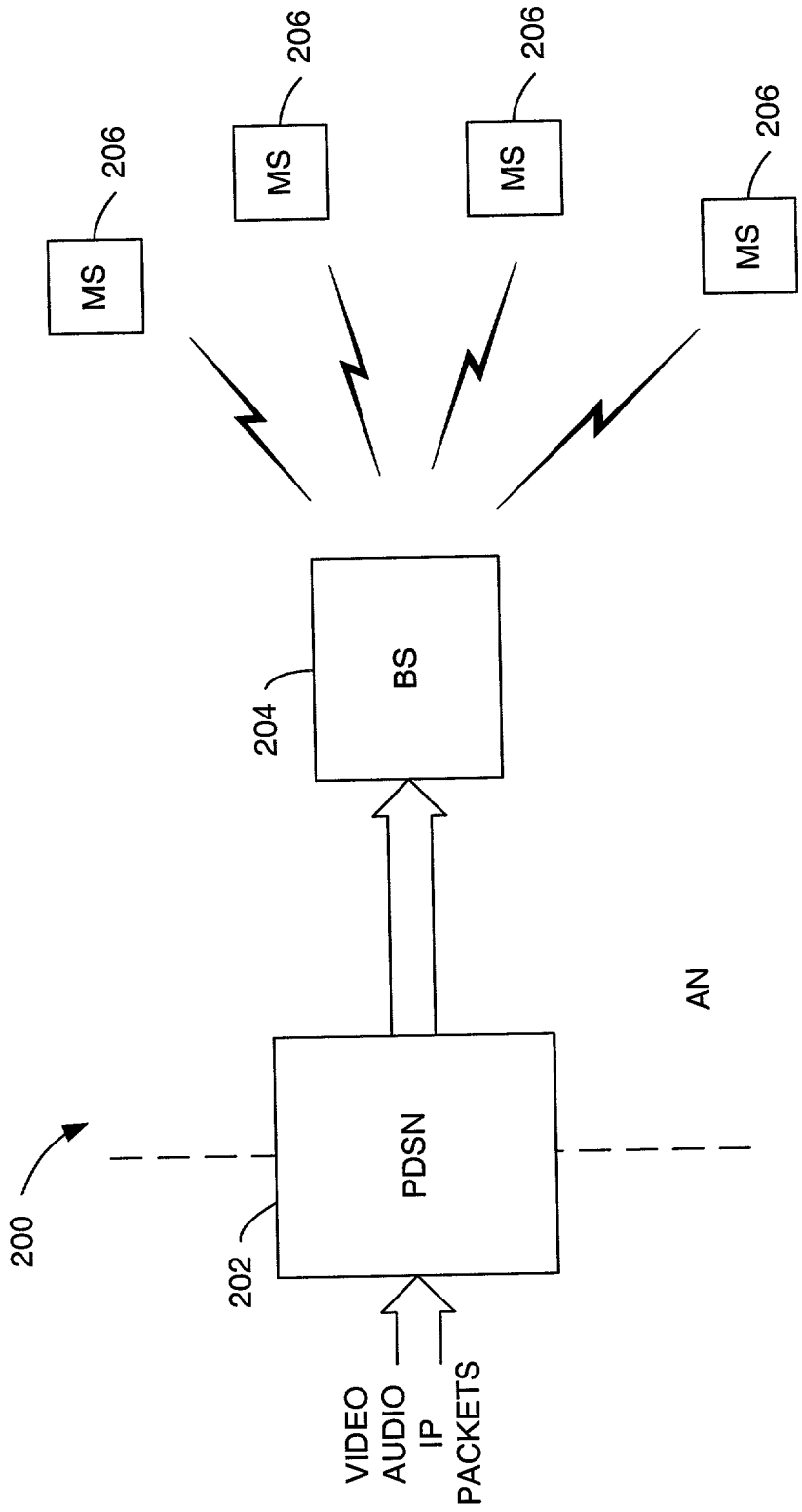
206
206
206
206
MS
MS
MS
MS
BS
204
AN
PDSN
202
200
VIDEO
AUDIO
IP
PACKETS

FIG. 2

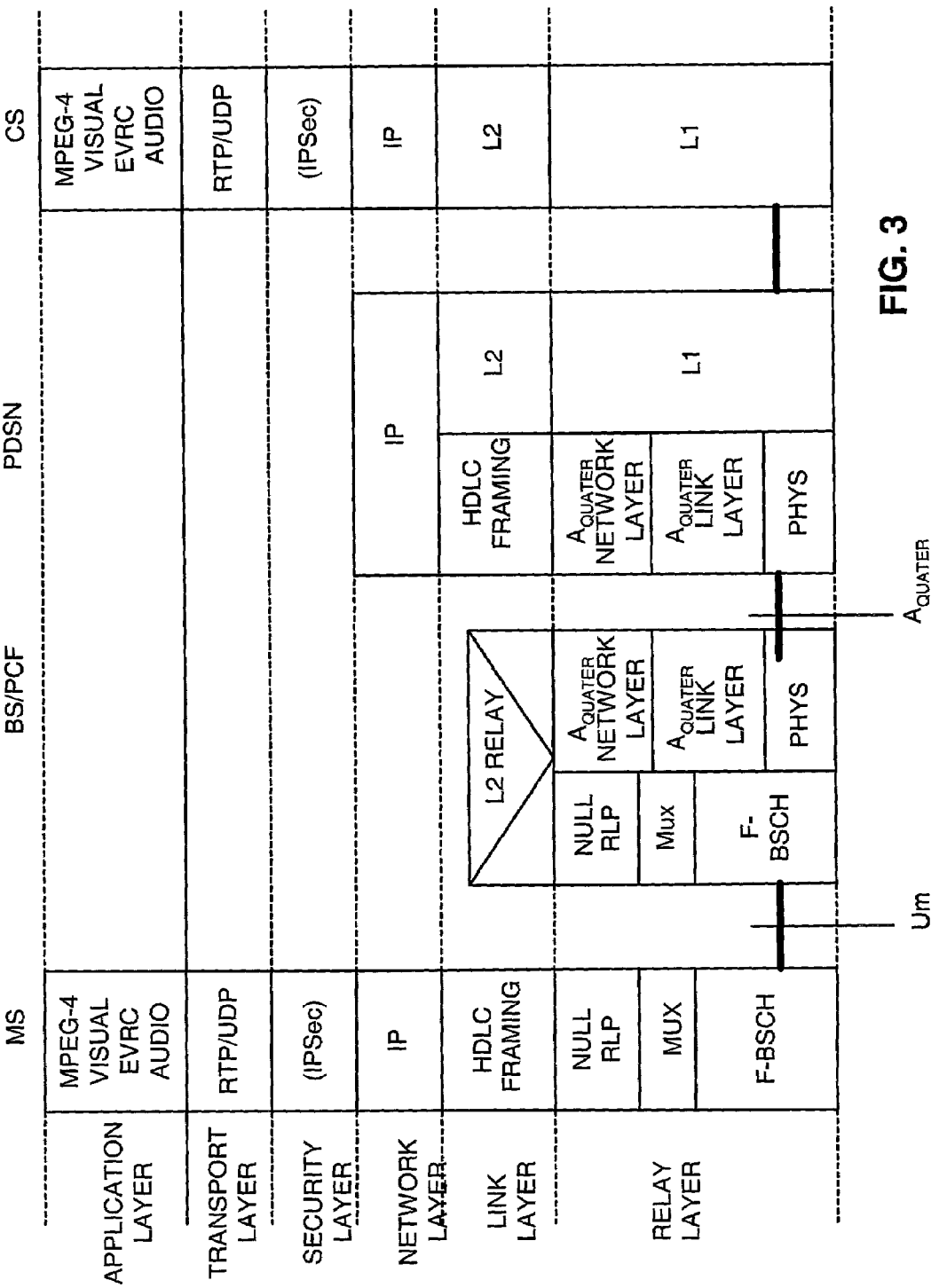
MS
BS/PCF
PDSN
CS
APPLICATION LAYER
TRANSPORT LAYER
SECURITY LAYER
NETWORK LAYER
LINK LAYER
RELAY LAYER
MPEG-4 VISUAL EVRC AUDIO
RTP/UDP
(IPSec)
IP
HDLC FRAMING
NULL RLP
MUX
F-BSCH
L2 RELAY
A QUATER NETWORK LAYER
A QUATER LINK LAYER
PHYS
L2
L1
Um
A QUATER

FIG. 3

LAYER	PROTOCOLS AND SELECTED OPTIONS FOR SERVICE OPTION XX
APPLICATION	MPEG-4 VISUAL, EVRC AUDIO, RTP PAYLOAD TYPES
TRANSPORT	RTP/UDP PORT NUMBER
SECURITY	UNSPECIFIED
NETWORK	IP
HEADER COMPRESSION	ROHC
LINK	HDLC-TYPE FRAMING
RLP	NULL
MULTIPLEX	BSPM
PHYSICAL	BSPM

FIG. 4

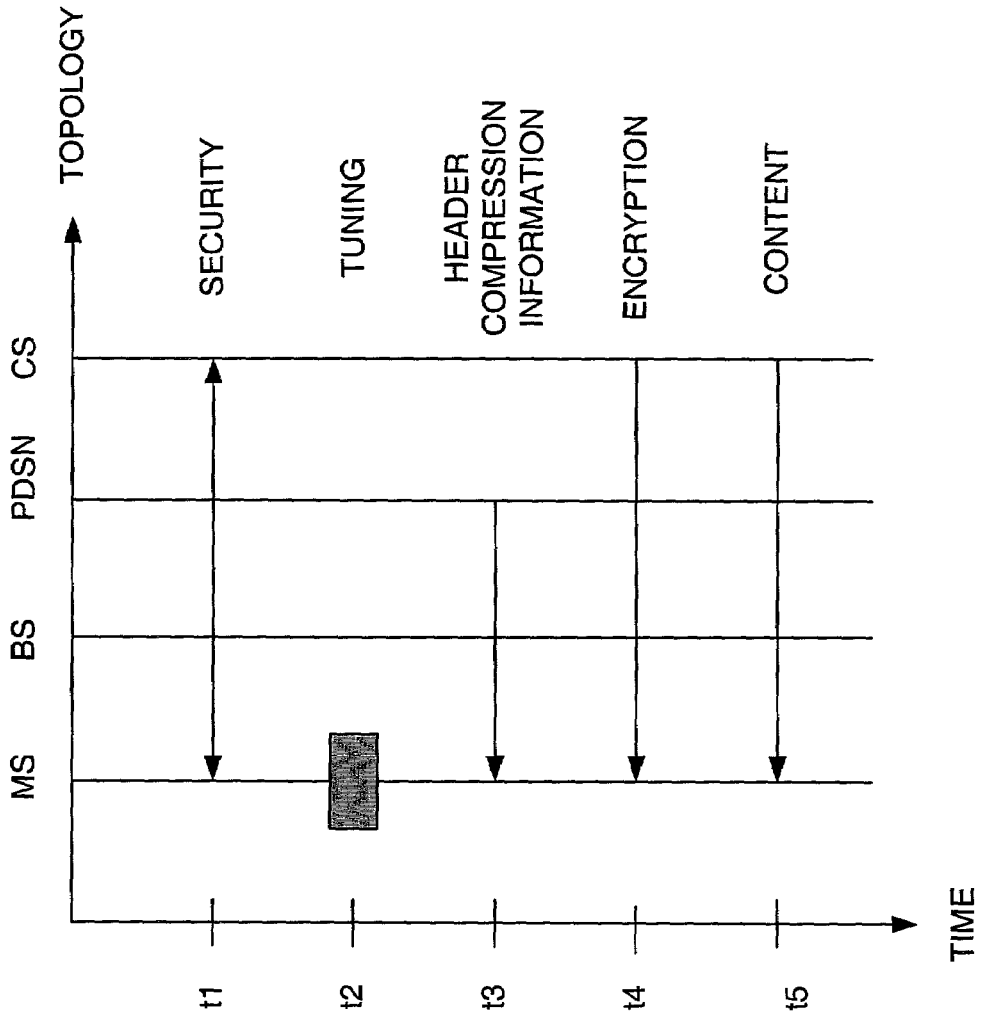
TOPOLOGY
SECURITY
TUNING
HEADER COMPRESSION INFORMATION
ENCRYPTION
CONTENT
CS
PDSN
BS
MS
TIME
t1
t2
t3
t4
t5

FIG. 5

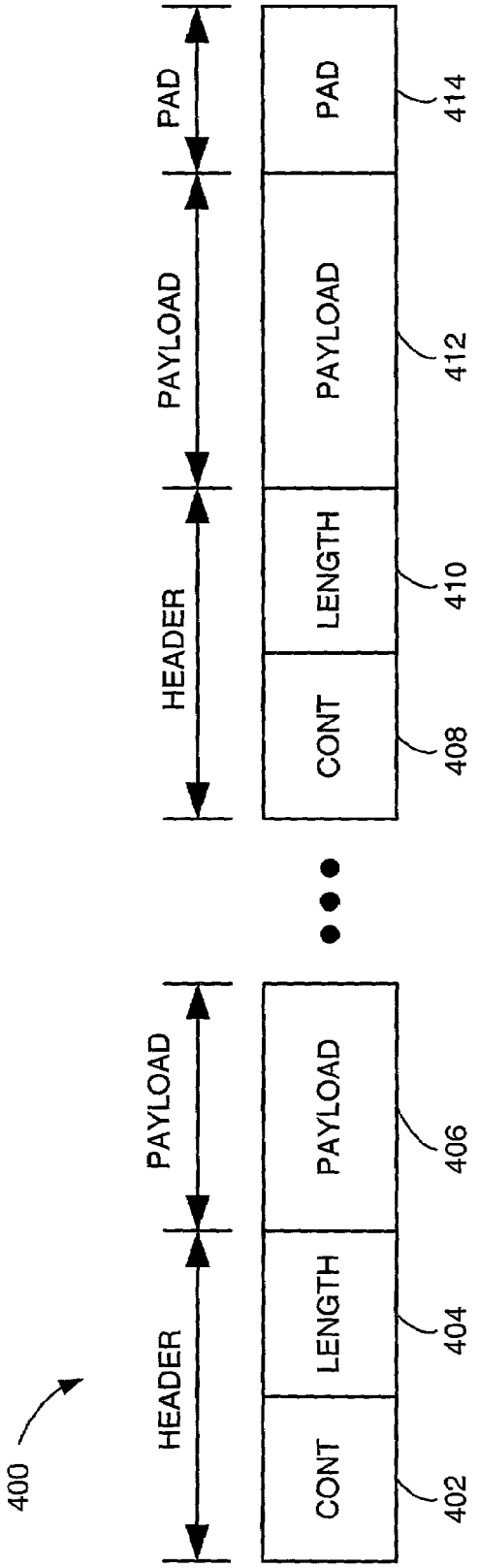
400
HEADER
PAYLOAD
CONT
LENGTH
PAYLOAD
402
404
406
HEADER
PAYLOAD
PAD
CONT
LENGTH
PAYLOAD
PAD
408
410
412
414

FIG. 6

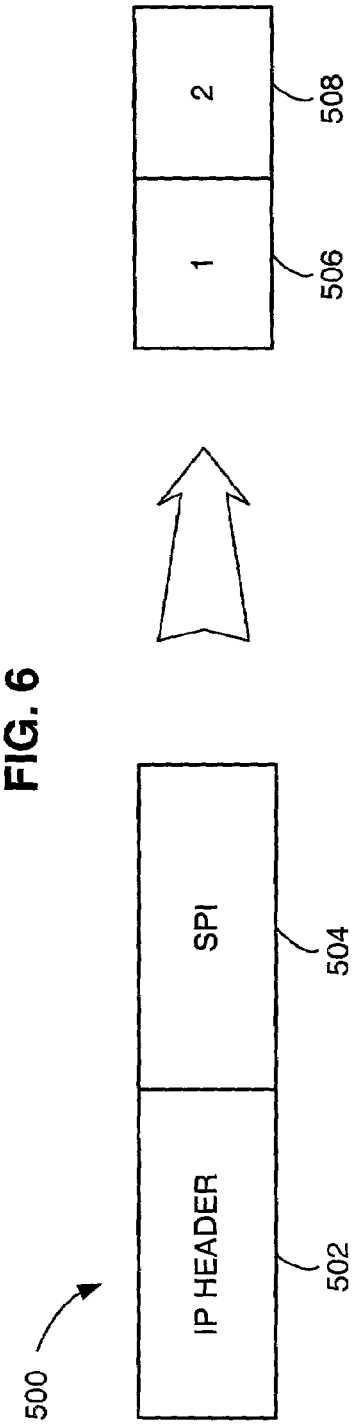
500
IP HEADER
SPI
1
2
502
504
506
508

FIG. 7

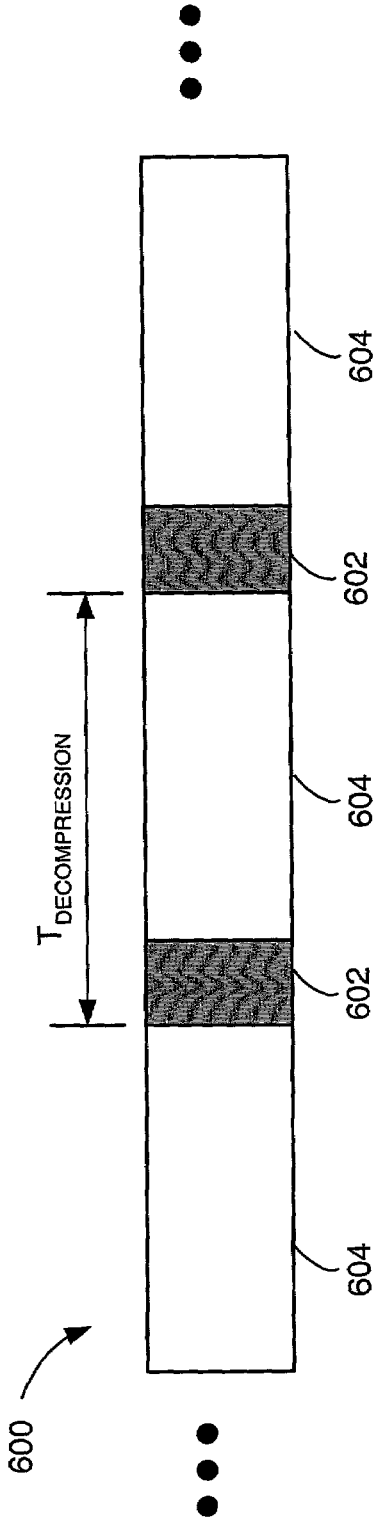

FIG.8

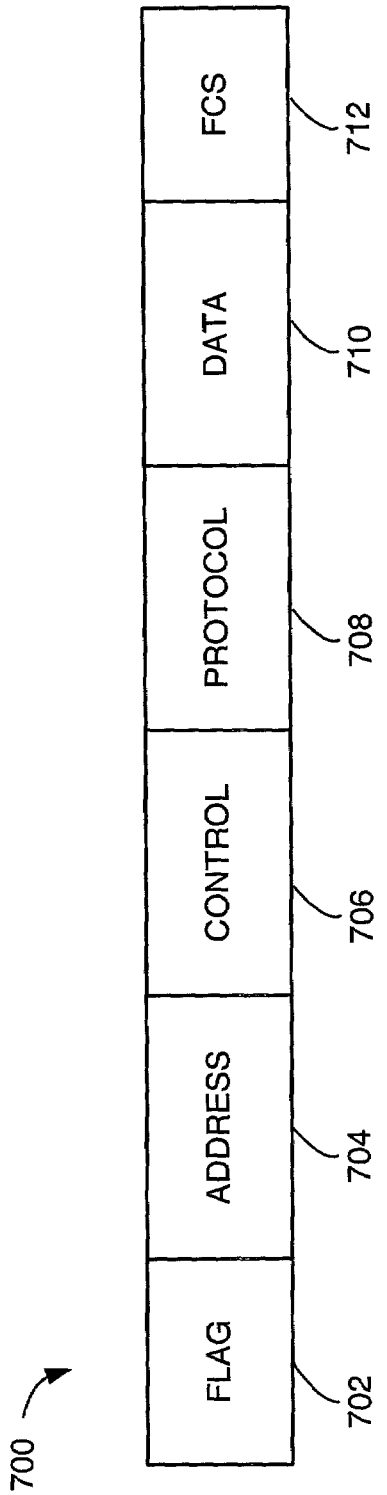
700
FLAG
ADDRESS
CONTROL
PROTOCOL
DATA
FCS
702
704
706
708
710
712

FIG. 9

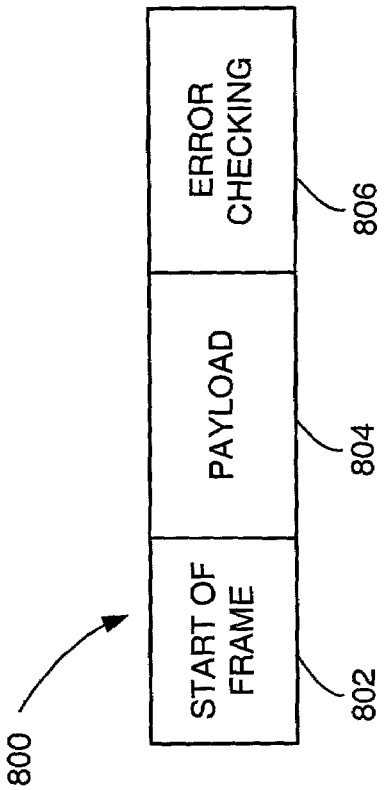
800
START OF FRAME
PAYLOAD
ERROR CHECKING
802
804
806

FIG. 10

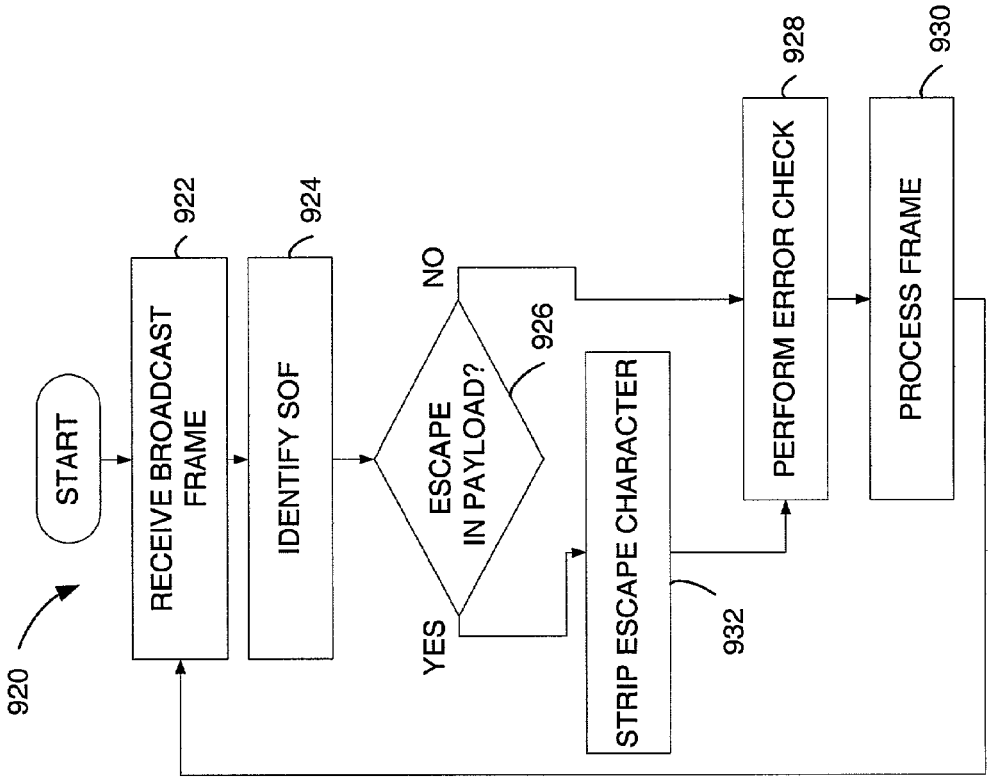
920
START
922
RECEIVE BROADCAST FRAME
924
IDENTIFY SOF
926
ESCAPE IN PAYLOAD?
NO
YES
932
STRIP ESCAPE CHARACTER
928
PERFORM ERROR CHECK
930
PROCESS FRAME

FIG. 12

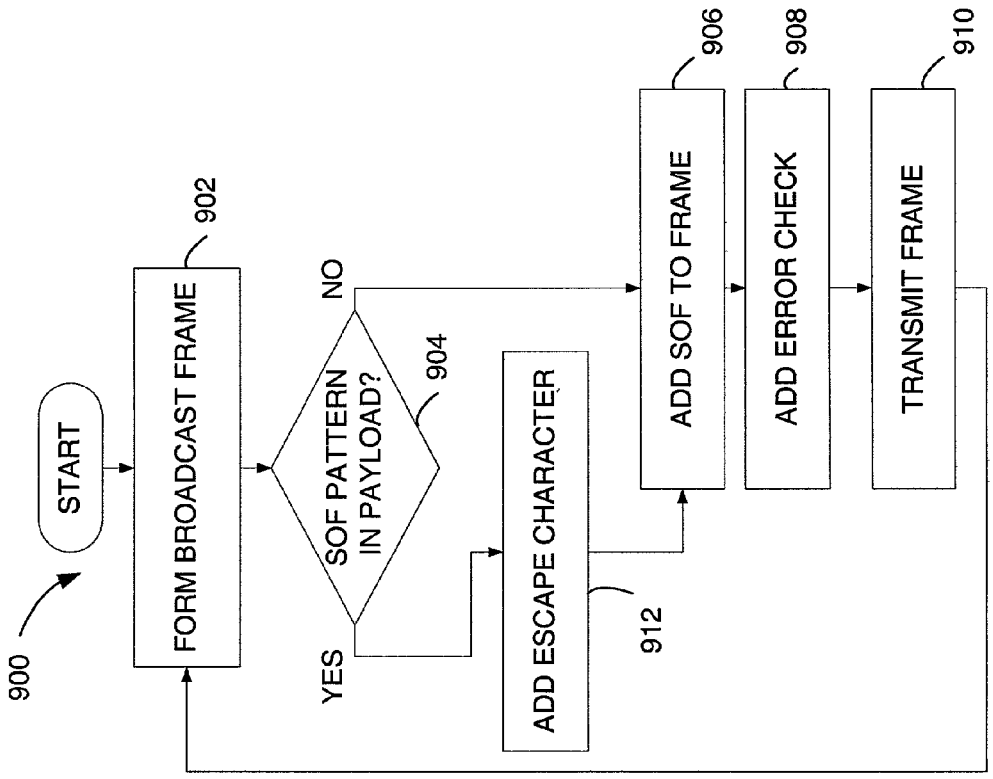
900
START
902
FORM BROADCAST FRAME
904
SOF PATTERN IN PAYLOAD?
NO
YES
912
ADD ESCAPE CHARACTER
906
ADD SOF TO FRAME
908
ADD ERROR CHECK
910
TRANSMIT FRAME

FIG. 11

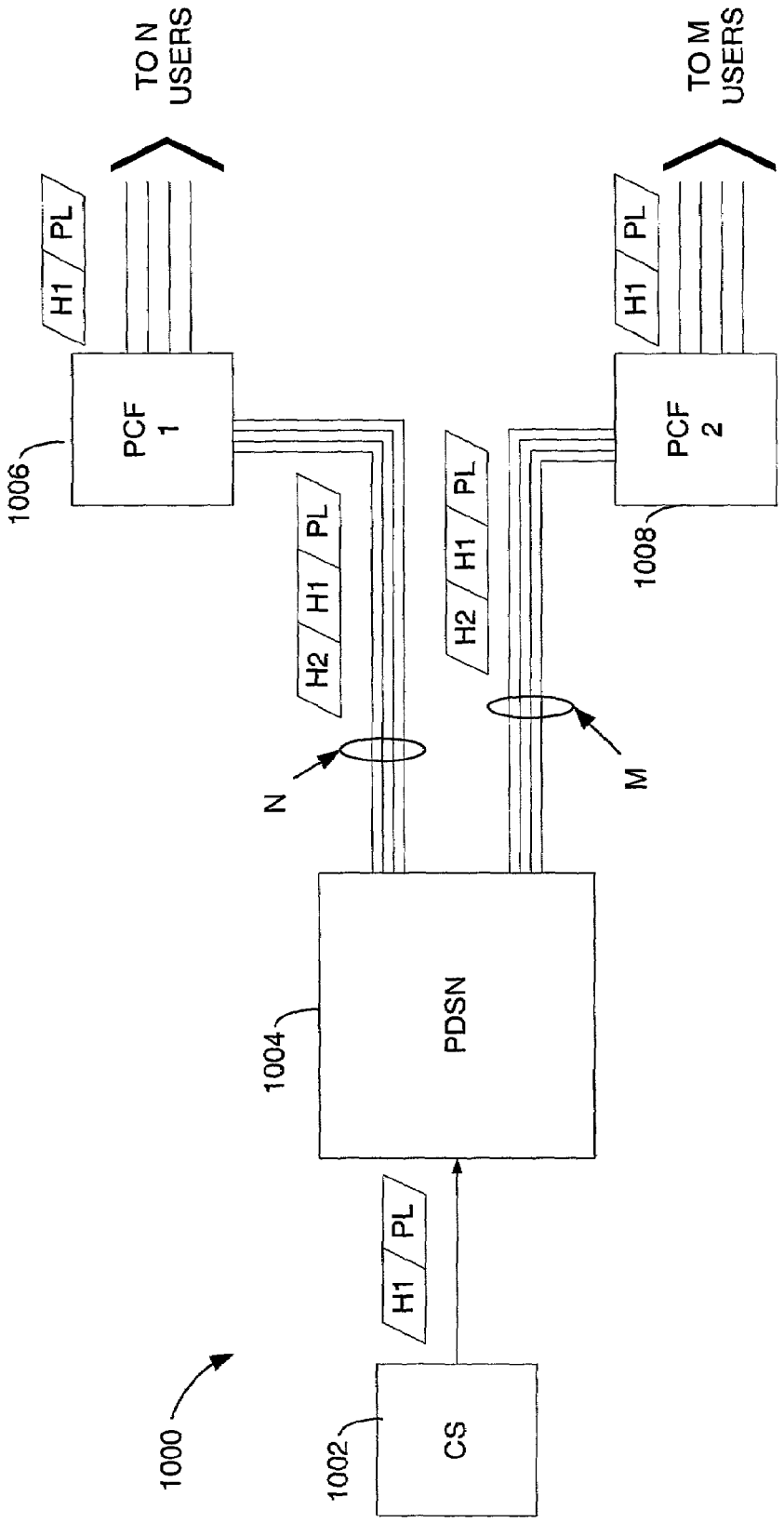
TO N USERS
TO M USERS
H1 PL
H2 H1 PL
PCF 1
PCF 2
1006
1008
N
M
PDSN
1004
CS
1002
1000

FIG. 13

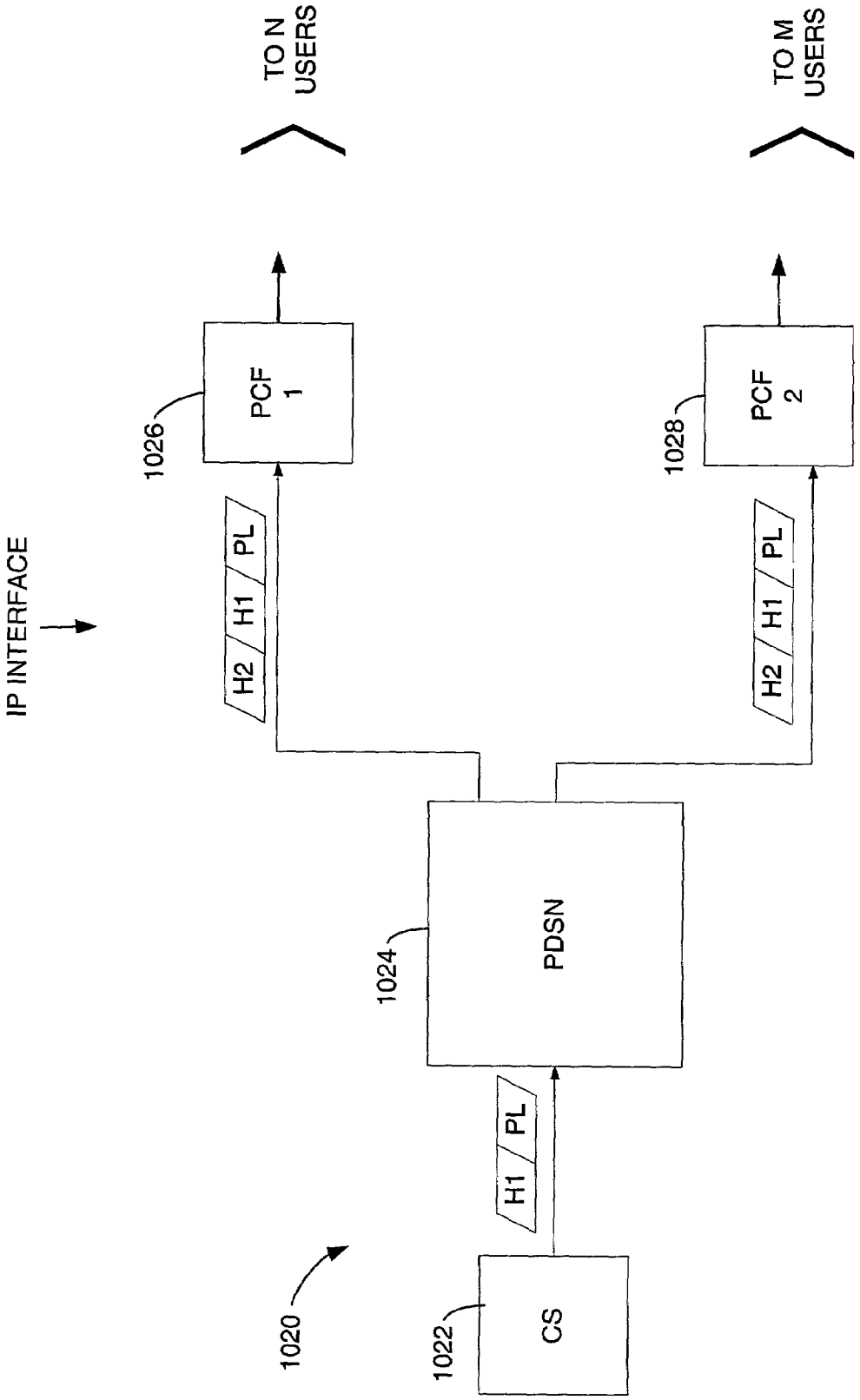
IP INTERFACE
1020
CS
1022
H1
PL
PDSN
1024
H2
H1
PL
PCF 1
1026
H2
H1
PL
PCF 2
1028
TO N USERS
TO M USERS

FIG. 14

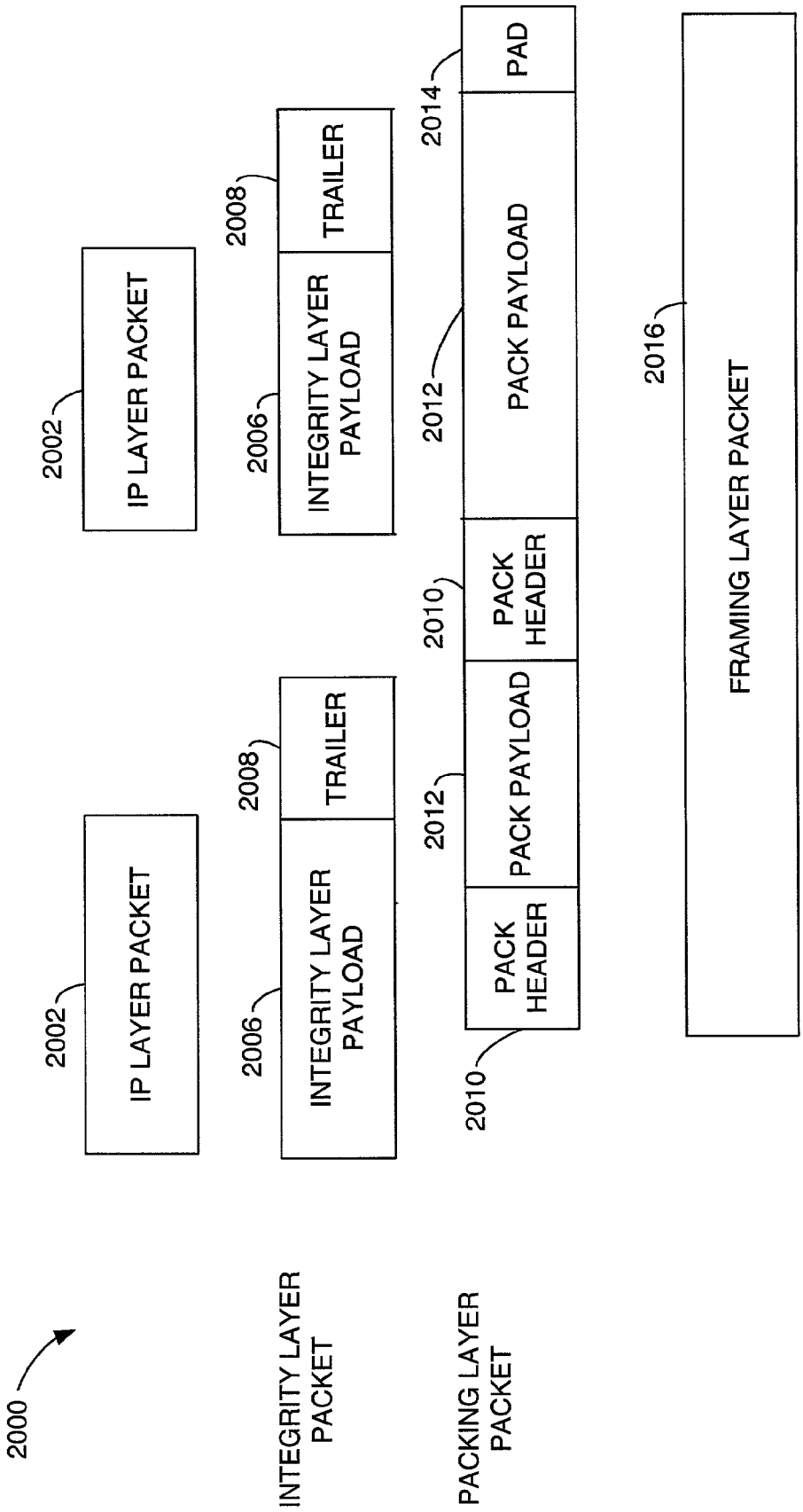
2000
INTEGRITY LAYER PACKET
PACKING LAYER PACKET
2002
IP LAYER PACKET
2006
INTEGRITY LAYER PAYLOAD
2008
TRAILER
2010
PACK HEADER
2012
PACK PAYLOAD
2014
PAD
2016
FRAMING LAYER PACKET

FIG. 15

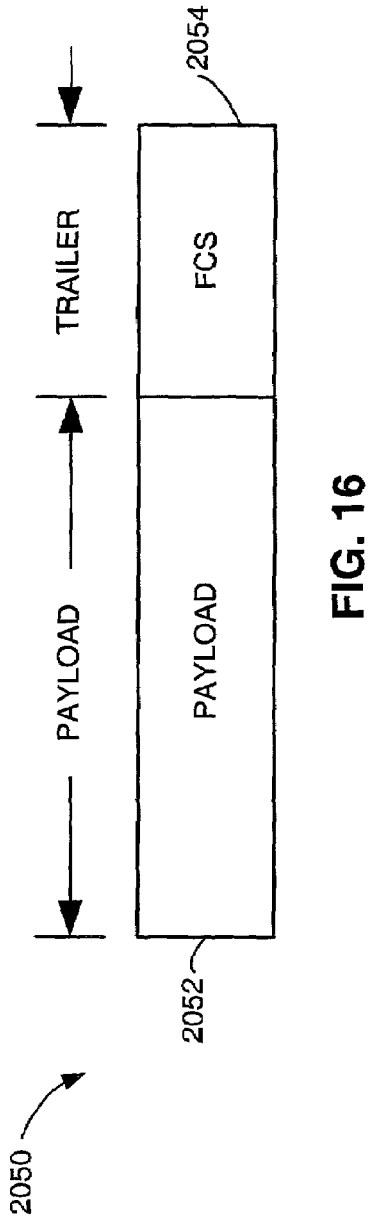
2050
PAYLOAD
TRAILER
PAYLOAD
FCS
2052
2054

FIG. 16

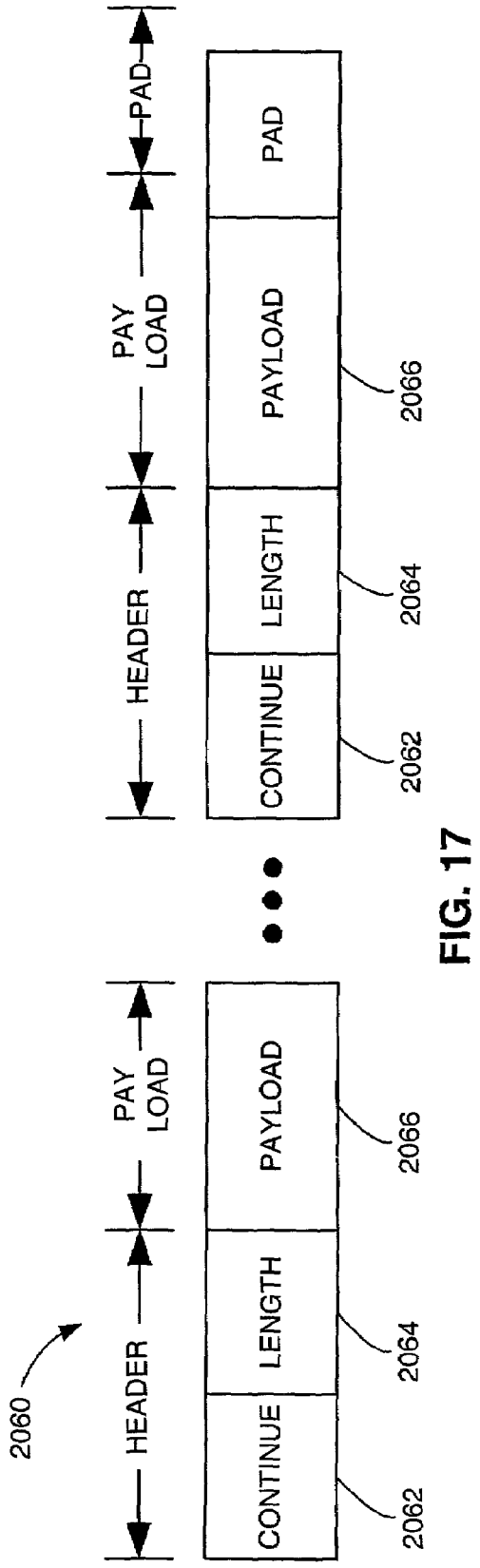
2060
HEADER
PAY LOAD
CONTINUE
LENGTH
PAYLOAD
2062
2064
2066
HEADER
PAY LOAD
CONTINUE
LENGTH
PAYLOAD
PAD
2062
2064
2066

FIG. 17

METHOD AND APPARATUS FOR TRANSMISSION FRAMING IN A WIRELESS COMMUNICATION SYSTEM

CLAIM OF PRIORITY UNDER 35 U.S.C. §120

The present Application for Patent claims priority of U.S. Provisional Application No. 60,279,970, filed 60/279,970, filed Mar. 28, 2001 assigned to The assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

REFERENCE TO CO-PENDING APPLICATIONS FOR PATENT

The present invention is related to the following Applications for Patent in the U.S. Patent & Trademark Office:

- "Method and Apparatus for Security in a Data Processing System" by Philip Hawkes et al., having U.S. application Ser. No. 09/933,972, filed Aug. 20, 2001, and assigned to the assignee hereof, and which is expressly incorporated by reference herein;
- "Method and Apparatus for Overhead Messaging in a Wireless Communication System" by Nikolai Leung, having U.S. application Ser. No. 09/933,971, filed Aug. 20, 2001, and assigned to the assignee hereof, and which is expressly incorporated by reference herein;
- "Method and Apparatus for Out-of-Band Transmission of Broadcast Service Option in a Wireless Communication System" by Nikolai Leung, having U.S. application Ser. No. 09/934,021, filed Aug. 20, 2005, and assigned to the assignee hereof, and which is expressly incorporated by reference herein;
- "Method and Apparatus for Broadcast Signaling in a Wireless Communication System" by Nikolai Leung, having U.S. application Ser. No. 09/933,914, filed Aug. 20, 2001, and assigned to the assignee hereof and which is expressly incorporated by reference herein;
- "Method and Apparatus for Header Compression in a Wireless Communication System" by Raymond Hsu, having U.S. application Ser. No. 09/933,690, filed Aug. 20, 2001, and assigned to the assignee hereof, and which is expressly incorporated by reference herein; and
- "Method and Apparatus for Data Transport in a Wireless Communication System" by Raymond Hsu, having U.S. application Ser. No. 09/933,977, filed Aug. 20, 2001, and assigned to the assignee hereof, and which is expressly incorporated by reference herein.

Field

The present invention relates to wireless communication systems generally and specifically, to methods and apparatus for message compression in preparation for transmission in a wireless communication system.

Background

There is an increasing demand for packetized data services over wireless communication systems. As traditional wireless communication systems are designed for voice communications, the extension to support data services introduces many challenges. The conservation of bandwidth is the overwhelming concern for most designers

The transmission protocols and data preparation methods used for a bi-directional communication may not be optimum for a uni-directional service, such as a broadcast service, wherein the bi-directional communication requires information not used in the unit-directional transmission. There is a need, therefore, for an efficient and accurate method of uni-directional transmission in a wireless communication system.

SUMMARY

Embodiments disclosed herein address the above stated needs by providing a method for framing data packets in a data processing system.

In one aspect, a method for framing packets in a wireless transmission system supporting broadcast transmissions includes generating a portion of an Internet Protocol (IP) packet for transmission, appending a start of frame indicator to the portion of the IP packet, applying an error checking mechanism to the portion of the IP packet, preparing a frame for transmission, having the start of frame indicator, the portion of the IP packet, and the error checking mechanism, and transmitting the frame without protocol information.

In another aspect, a communication signal transmitted via a carrier wave, having a payload portion corresponding to at least a portion of an Internet Protocol (IP) packet of digital information, a start of frame portion corresponding to the payload portion, and identifying a status of the payload portion within an IP packet, and an error checking portion for verifying the payload portion.

In still another aspect, a method for receiving framed packets in a wireless transmission system supporting broadcast transmissions includes receiving a frame of a packet transmission, the frame having a start of frame portion, a payload portion, and an error check portion, the frame not including protocol information, identifying the frame as a start frame in the packet transmission, verifying the frame using the error check portion of the frame, and processing the payload portion of the frame.

In yet another aspect, a computer program stored on a computer-readable storage unit, the computer program for receiving framed packets in a wireless transmission system supporting broadcast transmissions, the computer program includes a first set of instructions for receiving a frame of a packet transmission, the frame having a start of frame portion, a payload portion, and an error check portion, the frame not including protocol information, a second set of instructions for identifying the frame as a start frame in the packet transmission, a third set of instructions for verifying the frame using the error check portion of the frame, and a fourth set of instructions for processing the payload portion of the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram of a spread spectrum communication system that supports a number of users.

FIG. **2** is a block diagram of the communication system supporting broadcast transmissions.

FIG. **3** is a model of the protocol stack corresponding to a broadcast service option in a wireless communication system.

FIG. **4** is a table of protocols applied to layers of a protocol stack supporting a broadcast service option in a wireless communication system.

FIG. **5** is a flow diagram for a message flow for broadcast service in a wireless communication system topology.

FIG. **6** is a broadcast stream in a wireless communication system.

FIG. **7** is a header compression mapping in a wireless communication system.

FIG. **8** is a periodic broadcast of header compression information.

FIG. **9** is a header compression protocol.

FIG. **10** is a header compression protocol for broadcast service in a wireless communication system.

FIG. **11** is a flow chart of header compression for broadcast service in a wireless communication system.

FIG. **12** is a flow diagram of header decompression for broadcast service in a wireless communication system.

FIGS. **13** and **14** are access networks supporting broadcast transmissions.

FIGS. **15-17** illustrate a framing protocol.

DETAILED DESCRIPTION

The word "exemplary" is used exclusively herein to mean "serving as an example, instance, or illustration." Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

Optimization of a system consistent with the broadcast service is desirable in a wireless communication system to conserve a critical resource: the available bandwidth. The efficient use of available bandwidth impacts the performance and breadth of the system. Toward that end, various techniques have been applied to reduce the size of overhead information transmitted along with the data or content information as well as to reduce the size of the data transmitted. For example, in a digital transmission, data is transmitted in frames. The frames may be part of a packet of data, part of a data message, or continuous frames in a stream of information, such as audio and/or video streams. Attached to each frame of data (and each packet or message) is a header containing processing information that allows the receiver to understand the information contained in the frame(s). This header information is considered overhead, i.e., processing information transmitted along with information content. The information content is referred to as the payload. While each individual header is typically much smaller than a given payload, the cumulative effect of transmitting headers impacts the available bandwidth.

An exemplary embodiment of a wireless communication system employs a method of framing that reduces the size of the frame while satisfying the accuracy and transmission requirements of the system. The exemplary embodiment supports a unidirectional broadcast service. The broadcast service provides video and/or audio streams to multiple users. Subscribers to the broadcast service "tune in" to a designated channel to access the broadcast transmission. As the bandwidth requirement for high speed transmission of video broadcasts is great, it is desirable to reduce the size of any overhead associated with such broadcast transmission.

The following discussion develops the exemplary embodiment by first presenting a spread-spectrum wireless communication system generally. Next, the broadcast service is introduced; wherein the service is referred to as High Speed Broadcast Service (HSBS), and the discussion includes channel assignments of the exemplary embodiment. A subscription model is then presented including options for paid subscriptions, free subscriptions, and hybrid subscription plans, similar to those currently available for television transmissions. The specifics of accessing the broadcast service are then detailed, presenting the use of a service option to define the specifics of a given transmission. The message flow in the broadcast system is discussed with respect to the topology of the system, i.e., infrastructure elements. Finally, the header compression used in the exemplary embodiment is discussed

Note that the exemplary embodiment is provided as an exemplar throughout this discussion; however, alternate embodiments may incorporate various aspects without departing from the scope of the present invention. Specifically, the present invention is applicable to a data processing system, a wireless communication system, a unidirectional broadcast system, and any other system desiring efficient transmission of information.

Wireless Communication System

The exemplary embodiment employs a spread-spectrum wireless communication system, supporting a broadcast service. Wireless communication systems are widely deployed to provide various types of communication such as voice, data, and so on. These systems may be based on code division multiple access (CDMA), time division multiple access (TDMA), or some other modulation techniques. A CDMA system provides certain advantages over other types of system, including increased system capacity.

A system may be designed to support one or more standards such as the "TIA/EIA/IS-95-B Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System" referred to herein as the IS-95 standard, the standard offered by a consortium named "3rd Generation Partnership Project" referred to herein as 3GPP, and embodied in a set of documents including Document Nos. 3G TS 25.211, 3G TS 25.212, 3G TS 25.213, and 3G TS 25.214, 3G TS 25.302, referred to herein as the W-CDMA standard, the standard offered by a consortium named "3rd Generation Partnership Project 2" referred to herein as 3GPP2, and TR-45.5 referred to herein as the cdma2000 standard, formerly called IS-2000 MC. The standards cited hereinabove are hereby expressly incorporated herein by reference.

Each standard specifically defines the processing of data for transmission from base station to mobile, and vice versa. As an exemplary embodiment the following discussion considers a spread-spectrum communication system consistent with the CDMA200 standard of protocols. Alternate embodiments may incorporate another standard. Still other embodiments may apply the compression methods disclosed herein to other types of data processing systems.

FIG. **1** serves as an example of a communications system **100** that supports a number of users and is capable of implementing at least some aspects and embodiments of the invention. Any of a variety of algorithms and methods may be used to schedule transmissions in system **100**. System **100** provides communication for a number of cells **102**A through **102**G, each of which is serviced by a corresponding base station **104**A through **104**G, respectively. In the exemplary embodiment, some of base stations **104** have multiple receive antennas and others have only one receive antenna. Similarly, some of base stations **104** have multiple transmit antennas, and others have single transmit antennas. There are no restrictions on the combinations of transmit antennas and receive antennas. Therefore, it is possible for a base station **104** to have multiple transmit antennas and a single receive antenna, or to have multiple receive antennas and a single transmit antenna, or to have both single multiple transmit and receive antennas.

FIG. **1** serves as an example of a communications system **100** that supports a number of users and is capable of implementing at least some aspects and embodiments of the invention. Any of a variety of algorithms and methods may be used to schedule transmissions in system **100**. System **100** provides communication for a number of cells **102**A through **102**G. each of which is serviced by a corresponding base station **104**A through **104**G, respectively. It is appreciated

what the term "base station **104**," used throughout the specification, refers to "base stations **104**A, **104**B, **104**C, **104**D, **104**E, **104**F and **104**G." The term "base station **104**" is used for the sake of conciseness, only. In the exemplary embodiment some of base stations **104** have multiple receive antennas and others have only one receive antenna. Similarly, some of base stations **104** have multiple transmit antennas, and others have single transmit antennas. There are no restrictions on the combinations of transmit antennas and receive antennas. Therefore, it is possible for a base station **104** to have multiple transmit antennas and a single receive antenna, or to have multiple receive antennas and a single transmit antenna, or to have both single or multiple transmit and receive antennas.

Terminals **106** in the coverage area may be fixed (i.e., stationary) or mobile. As Shown in FIG. **1**, various terminals **106** are dispersed throughout the system. It is appreciated that the term "terminal **106**," used throughout the specification, refers to "terminals **106**A, **106**B, **106**C, **106**D, **106**E, **106**F and **106**G." The term "terminal **106**" is used for the sake of conciseness, only. Each terminal **106** communicates with at least one and possibly more base stations **104** on the dowmlink and uplink at any given moment depending on, for example, whether soft handoff is employed or whether the terminal is designed and operated to (concurrently or sequentially) receive multiple transmissions from multiple base stations. Soft handoff in CDMA communications systems is well known in the art and is described in detail in U.S. Pat. No. 5,101,501, entitled "Method and system for providing a Soft Handoff in a CDMA Cellular Telephone System," which is assigned to the assignee of the present invention.

The downlink, or FL, refers to transmission from the base station to the terminal, and the uplink, or RL, refers to transmission from the terminal in the base station. In the exemplary embodiment, some of terminals **106** have multiple receive antennas and others have only one receive antenna. In FIG. **1**, base station **104**A transmits data to terminals **106**A and **106**J on the downlink, base station **104**B transmits data to terminals **106**B and **106**J, base station **104**C transmits data to terminal **106**C, and so on.

High Speed Broadcast System (HSBS)

A wireless communication system **200** is illustrated in FIG. **2**, wherein video and audio information is provided to Packetized Data Service Network (PDSN) **202**. The video and audio information may be from televised programming or a radio transmission. The information is provided as packetized data, such as in IP packets. The PDSN **202** processes the IP packets for distribution within an Access Network (AN). As illustrated the AN is defined as the portions of the system including a BS **204** in communication with multiple MS **206**. The PDSN **202** is coupled to the BS **204**. For HSBS service, the BS **204** receives the stream of information from the PDSN **202** and provides the information on a designated channel to subscribers within the system **200**.

In a given sector, there are several ways in which the HSBS broadcast service may be deployed. The factors involved in designing a system include, but are not limited to, the number of HSBS sessions supported, the number of frequency assignments, and the number of broadcast physical channels supported.

The HSBS is a stream of information provided over an air interface in a wireless communication system. The "HSBS channel" to refer to a single logical HSBS broadcast session as defined by broadcast content. Note that the content of a given HSBS channel may change with time, e.g., 7 am News, 8 am Weather, 9 am Movies, ect. The time based scheduling is analogous to a single TV channel. The "Broadcast channel" refers to a single forward link physical channel i.e., a given Walsh Code, that carreies broadcast traffic. The Broadcast Channel, BCH, corresponds to a signal CDM channel.

The HSBS is a stream of information provided over an air interface in a wireless communication system. The "HSBS channel" refers to a single logical HSBS broadcast session as defined by broadcast content. Note that the content of a given HSBS channel may change with time, e.g., 7 am News, 8 am Weather, 9 am Movies, etc. The time based scheduling is analogous to a single TV channel. The "Broadcast channel" refers to a single forward link physical channel, i.e., a given Walsh Code, that carries broadcast traffic. The Broadcast Channel, BCH, corresponds to a single CDM channel.

According to the exemplary embodiment, the system **100** illustrated in FIG. **1** supports a high-speed multimedia broadcasting service referred to as High-Speed Broadcast Service (HSBS). The broadcast capabilities of the service are intended to provide programming at a data rate sufficient to support video and audio communications. As an example, applications of the HSBS may include video streaming of movies, sports events, etc. The HSBS service is a packet data service based on the Internet Protocol (IP).

According to the exemplary embodiment, a service provider is referred to as a Content Server (CS), wherein the CS advertises the availability of such high-speed broadcast service to the system users. Any user desiring to receive the HSBS service may subscribe with the CS. The subscriber is then able to scan the broadcast service schedule in a variety of ways that may be provided by the CS. For example, the broadcast content may be communicated through advertisements, Short Management System (SMS) messages, Wireless Application Protocol (WAP), and/or some other means generally consistent with and convenient for mobile wireless communications. Mobile users are referred to as Mobile Stations (MSs). Base Stations (BSs) transmit HSBS related parameters in overhead messages, such as those transmitted on channels and/or frequencies designated for control and information, i.e., non-payload messages. Payload refers to the information content of the transmission, wherein for a broadcast session the payload is the broadcast content, i.e., the video program, etc. When a broadcast service subscriber desires to receive a broadcast session, i.e., a particular broadcast scheduled program, the MS reads the overhead messages and learns the appropriate configurations. The MS then tunes to the frequency containing the HSBS channel, and receives the broadcast service content.

The channel structure of the exemplary embodiment is consistent with the cdma2000 standard, wherein the Forward Supplemental Channel (F-SCH) supports data transmissions. One embodiment bundles a large number of the Forward Fundamental Channels (F-FCHs) or the Forward Dedicated Control Channels (F-DCCHs) to achieve the higher data rate requirements of data services. The exemplary embodiment utilizes an F-SCH as the basis for the F-BSCH supporting a payload of 64 kbps (excluding RTP overhead). The F-BSCH may also be modified to support other payload rates, for example, by subdividing the 64-kbps payload rate into substreams of lower rates.

One embodiment also supports group calls in several different ways. For example, by using existing unicast channels, i.e., one forward link channel per MS with no sharing, of F-FCH (or the F-DCCH) on both forward and reverse links. In another example, the F-SCH (shared by group members in the same sector) and the F-DCCH (no frames but the Forward Power Control Subchannel most of the time) on the forward link and the R-DCCH on the reverse link are applied. In still another example, the high-rate F-BSCH on the forward link

and the Access Channel (or the Enhanced Access Channel/Reverse Common Control Channel combination) on the reverse link is utilized.

Having a high data rate, the F-BSCH of the exemplary embodiment may use a very large portion of a base station's forward link power to provide adequate coverage. The physical layer design of HSBC is thus focused on efficiency improvements in a broadcast environment.

To provide adequate support for video services, system design considers the required base station power for various ways to transmit the channel as well as the corresponding video quality. One aspect of the design is a subjective trade-off between the perceived video quality at the edge of coverage and that close to the cell site. As the payload rate is reduced, the effective error correcting code rate is increased, a given level of base station transmit power would provide better coverage at the edge of the cell. For mobile stations located closer to the base stations, the reception of the channel remains error-free and the video quality would be lowered due to the lowered source rate. This same trade-off also applies to other, non-video applications that the F-BSCH can support. Lowering the payload rate supported by the channel increases the coverage at the expense of decreased download speed for these applications. The balancing the relative importance between video quality and data throughput versus coverage is objective. The configuration chosen seeks an application-specific optimized configuration, and a good compromise among all possibilities.

The payload rate for the F-BSCH is an important design parameter. The following assumptions may be used in designing a system supporting broadcast transmissions according to the exemplary embodiment: (1) the target payload rate is 64 kbps, which provides an acceptable video quality for SKT; (2) for streaming video services, the payload rate is assumed to include the 12 8-bit bytes per packet overhead of the RTP packets; (3) the average overhead for all layers between RTP and the physical layer is approximately 64, 8-bit bytes per packet plus 8 bits per F-SCH frame overhead used by the MUXPDU header.

In the exemplary embodiment, for non-video broadcast services, the maximum rate supported is 64 kbps. However, many other possible payload rates below 64 kbps are also achievable.

Subscription Model

There are several possible subscription/revenue models for HSBS service, including free access, controlled access, and partially controlled access. For free access, no subscription is needed by the to receive the service. The BS broadcasts the content without encryption and interested mobiles can receive the content. The revenue for the service provider can be generated through advertisements that may also be transmitted in the broadcast channel. For example, upcoming movie-clips can be transmitted for which the studios will pay the service provider.

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A hybrid access scheme, referred to as partial controlled access, provides the HSBS service as a subscription-based service that is encrypted with intermittent unencrypted advertisement transmissions. These advertisements may be intended to encourage subscriptions to the encrypted HSBS service. Schedule of these unencrypted segments could be known to the MS through external means.

HSBS Service Option

The HSBS service option is defined by: (1) a protocol stack; (2) options in the protocol stack; and (3) procedures for setting up and synchronizing the service. The protocol stack according to the exemplary embodiment is illustrated in FIGS. **3** and **4**. As illustrated in FIG. **3**, the protocol stack is specific to the infrastructure element, i.e., MS, BS, PDSN and CS in the exemplary embodiment.

Continuing with FIG. **3**, for the application layer of the MS, the protocol specifies audio codec, visual codec, as well as any visual profiles. Additionally, the protocol specifies Radio Transport Protocol (RTP) payload types when RTP is used. For the transport layer of the MS, the protocol specifies a User Datagram Protocol (UDP) port. The security layer of the MS is specified by the protocol, wherein security parameters are provided via out-of-band channels when the security is initially associated with the CS. The network layer specifies the IP header compression parameters.

Message Flow

Continuing with FIG. **3**, for the application layer of the MS, the protocol specifies audio codec, visual codec, as well as any visual profiles. Additionally, the protocol specifies Radio Transport Protocol (RTP) payload types when RTP is used. For the transport layer of the MS, the protocol specifies a User Datagram Protocol (UDP) port to be used to carry the RTP packets. The security layer of the MS is specified by the protocol (IP sec), wherein security parameters are provided via out-of-band channels when the security association is initially established with the CS. The link layer specifies the IF header compression parameters. As illustrated, processing information used for transmission by the CS and rectuired by the MS, is not necessarily needed to be known by the BS/PCF or PDSN. Such information may include IPsec information. MPEG information, etc.

At time t**2** the MS tunes into the broadcast channel and starts to receive packets. At this point in time, the MS is unable to process the received packets because the IP/ESP header is compressed via ROHC, and the MS's decompressor has not been initialized. The PDSN provides header compression information (detailed hereinbelow) at time t**3**. From the ROHC packet header, the MS detects and obtains a ROHC Initialization & Refresh (IR) packet sent periodically from the PDSN to the broadcast channel. The ROHC IR packet is used to initialize the state of decompressor in the MS, allowing it to decompress the IP/ESP header of the received packets. The MS is then able to process the IP/ESP header of the received packets, however, the MS requires further information to process the ESP payload as the payload is encrypted with a Short-term Key (SK) at the CS. The SK acts in coordination with the BAK, wherein the SK is decrypted at the receiver using the BAK. The CS provides further encryption information, such as updated key information or a current SK at time t**4**. Note that the CS provides this information periodically to the MS to ensure the ongoing security of the broadcast. At time t**5** the MS receives the broadcast content from the CS. Note that alternate embodiments may incorporate alternate compression and decompression methods that provide efficient transmission of the header information. Additionally, alternate embodiments may implement a variety of security schemes to protect the broadcast content. Still alternate embodiments may provide a non-secure broadcast service. The MS uses the encryption information, such as the SK, to decrypt and display broadcast content.

Compression

According to the exemplary embodiment, broadcast content is transmitted on a dedicated broadcast channel. The transport layer provides encryption overhead for carrying broadcast content in IP packets. The system supports data compression, and specifically header compression. The decision to compress data depends on the required average throughput (including transport/encryption overhead, data link layer overhead, and physical layer overhead) and user perception of the broadcast quality. Carrying more broadcast content in each IP packet reduces overhead and thus reduces the broadcast channel bandwidth. In contrast, compression increases the Packet Error Rate (PER) that affects user perception. This is due to the transmission of each long IP packet spanning multiple physical layer frames and thus is associated with increases in the Frame Error Rate (FER). If a carrier decides to use small IP packets to improve broadcast quality, the carrier may choose header compression to reduce the transport and encryption overhead of the IP packet.

The RTP/UDP/IP protocols are used to transport broadcast content from the CS to MS, and the content is protected by the Encapsulation Security Payload (ESP) in transport mode. The transport overhead is the RTP/UDP/IP header and is 40 bytes per IP packet data. The encryption overhead is in the form of ESP header, Initialization Vector (IV), and ESP trailer. The ESP header and IV are inserted between the IP header and UDP header. The ESP header consists of the Security Parameter Index (SPI) (4 bytes) and Sequence Number (4 bytes). The length of IV is specific to which encryption algorithm is used. For the AES Cipher Algorithm, the length of IV is 16 byte. The ESP trailer is appended to the end of the UDP datagram and consists of the padding, next header (1 byte), and padding length (1 byte). Since the cipher block size of the AES algorithm is 16 bytes, the padding size ranges from 0 to 15 bytes. Taking the ceiling function of the average padding size yields 8 bytes. For an IP packet the total overhead due to transport and encryption ranges from 66 to 81 bytes with the average of 74 bytes not including the data link layer overhead from the PDSN to the MS.

Header compression such as the Robust Header Compression (ROHC) may be used to reduce the IP header and the SPI field of the ESP Header from 24 bytes to 2 bytes. The Sequence Number of the ESP header is not compressed, because it is used to sequence the compressed packets. The IV is not compressed, because it changes randomly for every packet. The UDP/RTP header and ESP trailer cannot be compressed because they are encrypted. Therefore, if ROHC is used to compress the IP/ESP header, the average overhead due to transport and encryption is reduced from 74 bytes to 52 bytes per IP packet.

According to the exemplary embodiment, header compression, such as the Robust Header Compression (ROHC), is applied so as to avoid propagating decompression errors. As illustrated in FIG. **7**, the header information is compressed from 24 bytes down to 2 bytes. The header **500** includes an IP header **502** and a SPI portion **504**. The compression algorithm results in a 2-byte result after compression. In contrast to conventional header compression, wherein some type of negotiation is required between the MS and the PDSN or other infrastructure element, the exemplary embodiment provides a uni-directional transmission of compression information. The MS does need to request the compression information, i.e., header compression parameters sufficient for decompression of the received information at the MS. Rather, the PDSN provides the compression information periodically as illustrated in FIG. **8**. The PDSN provides the compression information on the broadcast channel interspersed with broadcast content. The provision of control information within a data stream is referred to as "in-band" as a separate channel is not required. As illustrated, the broadcast stream **600** includes broadcast content portions **604** and decompression information, i.e., compression information, **602**. The decompression information is provided having a period of $T_{DECOMPRESSION}$. Alternate embodiments may provide the decompression information on occurrence of a predetermined event rather than periodically. As the MS does not request the decompression information, the PDSN supplies the information with a frequency that prevents delays in accessing the broadcast content. In other words, the PDSN should provide the information often, so that an MS may access the broadcast at any time without having to wait for decompression information.

Note that ROHC may be operated in a unidirectional mode, wherein, packets are sent in one direction only: from compressor to decompressor. In this mode, therefore, makes ROHC usable over links wherein a return path from decompressor to compressor is unavailable or undesirable. Before the MS can decompress packets received from the broadcast channel, the state of decompressor is initialized. The Initialization & Refresh (IR) packet is used for this purpose. There are two alternatives for the ROHC initialization.

The subscriber "tunes" to the broadcast channel and waits for the ROHC IR packets periodically sent by the ROHC compressor in the PDSN. Frequent ROHC IR packets may be needed for the MS to start decompressing received packets quickly. Frequent ROHC IR packets may use too much bandwidth in the broadcast channel. An IR packet is about 30 bytes for the IP/ESP compression profile. If an IR packet is sent once every 250 ms., the process consumes about 1 kbps in the broadcast channel. Losing IR packets over the air would further delay the MS to acquire ROHC initialization.

If decompression goes out-of-sync, due to packet loss, or residual error in the received compressed header, or failure, etc., the resultant decompression error may propagate until decompression is re-synchronized or re-initialized. An ROHC compressed header contains a Cyclic Redundant Check (CRC), which is calculated over the entire header before compression. This CRC allows decompression to perform a local context repair that brings the context in sync (in the events of packet loss and residual error). When decompression recovers from a failure, periodic IR packets effectively reinitialize the decompression process.

Data Link Layer

A data link layer framing protocol or transport layer protocol is applied between the PDSN and the MS to delineate packets received from the broadcast channel. With reference to FIG. **3**, information in the transport layer, identified as LINK LAYER, is provided between the PDSN and the MS. The framing information is generated at the PDSN and is provided to the MS via the BS. The PDSN receives IP streams from the CS and frames the IP streams according to a predetermined framing protocol. As illustrated in the exemplary embodiment, the PDSN applies a framing protocol version of the High-Level Data Link Control (HDLC). The HDLC specified in the ISO standard corresponds to Layer 2 of the International Standards Organization (ISO) 7-layered architecture, wherein Layer 2 is referred to as the Data Link Layer. The HDLC protocol seeks to provide error-free movement of data between network nodes. To this end, the HDLC layer is designed to ensure the integrity of data passed to a next layer. In other words, the framing protocol seeks to reproduce the data received exactly as the data was originally transmitted, without errors, without loss of information, and in the correct order.

The exemplary embodiment applies a version of HDLC framing that applies a subset of the HDLC defined parameters. FIG. **9** illustrates one embodiment of HDLS framing, wherein frame **700** includes a plurality of fields as defined by the HDLC protocol outlined in RFC **1662**. Field **702** defines a FLAG or indication of a start of frame. The FLAG has a designated bit length and is defined by a predetermined pattern of bits. The HDLC is convenient to apply as the HDLC is a commonly available standardized protocol. One disadvantage of the full HDLC framing protocol is the processing time required to generate the frames at the transmitter and to retrieve the frames at the receiver.

In particular, the HDLC protocol is considered processor intensive as further processing is used to ensure the payload does not include the same sequence of bits as the FLAG. At the transmitter, if a FLAG sequence of bits is detected in the payload, an escape character is inserted into the payload to identify the FLAG as part of the payload and not indicating a start of frame. The process of adding an escape character is referred to as "escaping" hexadecimal patterns of 0x7E and 0x7D in the frame payload. An alternative method referred to as the Efficient Framing Protocol that is less processor intensive than the HDLC-like framing is described hereinbelow. FIG. **9** illustrates the options of using HDLC framing to transport PPP frame. For the HSBS operation, the HDLC-like framing overhead can be reduced by eliminating field that are not required, or have little meaning and/or provide little information, for a uni-directional broadcast. As described hereinabove, the FLAG is a predetermined sequence of bits indicating the beginning of an HDLC frame. The exemplary embodiment incorporates a FLAG or other start of frame indicator **802**, as illustrated within the format **800** of FIG. **10**. In contrast to the format of FIG. **9**, the end of a frame is not indicated with overhead information in the exemplary embodiment. As the address and control fields of the format **700** have static values, these are not included in the format **800**.

Continuing with FIG. **10**, as the purpose of the Protocol field **708** (FIG. **9**) is to identify the payload type, such as LCP control packet, ROHC packet, IP packet, etc., this discriminator is not required for broadcast operation as all packets in the broadcast channel belong to the same type. For example, if ROHC compression is used for packet transmission, all packets in the broadcast channel are processed as ROHC packets. The types of ROHC packets, such as IR packet, compressed packet, etc., are distinguished by the Packet Type field in the ROHC packet header. Therefore, the Protocol field is not included in format **800**. Further, the format **800** includes an error checking field **806** after the payload **804**. The error checking field **806** provides information to the receiver to allow the receiver to check for errors in the received payload. The exemplary embodiment incorporates a Frame Check Sum (FCS) which may be specified as null, 16 bits, or 32 bits. Since an HDLC frame may span multiple physical-layer frames in the broadcast channel, it is recommended to use a 16-bit FCS.

The octet stuffing procedure defined in RFC **1662** is also applied to the exemplary embodiment, wherein after the FCS computation, the HDLC transmitter in the PDSN examines each byte in the HDLC frame (excluding the Flag) for the patterns of 0x7E and 0x7D. The pattern 0x7E will be encoded as 0x7D and 0x5E, and the pattern 0x7D will be encoded as 0x7D and 0×5D. The HDLC transmitter will not encode any other patterns. This implies that the Async-Control-Character-Map (ACCM) as defined in RFC 1662 is set to all zero.

The HDLC framing overhead is 3 bytes plus the octet stuffing overhead. Assuming the byte pattern is uniformly distributed, the average octet stuffing overhead is one byte per 128-byte of HDLC frame. For example, if the payload is 256 bytes, the HDLC framing overhead is 5 bytes on the average.

FIG. **11** is a flow diagram of a framing method **900** performed at the transmitter. The transmitter forms the broadcast frame at step **902** by determining a payload portion of the packetized data and generating a Start Of Flag (SOF). The transmitter then checks the frame for any SOF sequences contained in the payload **904**. If an SOF sequence is found in the payload, the transmitter adds an escape character at step **912**. Else, the transmitter appends the SOF to the payload at step **906** and provides an error checking mechanism at step **908**. The frame is transmitted at step **910**. The transmitted frame has the format **800** of FIG. **10**. Alternate embodiments may implement other fields within the framing format and may incorporate any form of classifier to locate a SOF sequence in the payload.

FIG. **12** is a flow diagram of a de-framing method **920** performed at the receiver. The process starts on receipt of a broadcast frame at step **922**. The receiver identifies a SOF at step **924**, and checks for escape characters in the payload at decision diamond **926**. If an escape character, or other SOF sequence identifier, is found in the payload, the receiver strips the escape character at step **932**. Else, the receiver performs an error check at step **928** and processes the frame at step **930**.

An alternative embodiment incorporates a framing protocol that does not use the octet based HDLC-like framing used seeking to avoid the processor intensive operations which use octet stuffing (referred to as "escaping"). Instead, this alternative uses a packet-based framing layer which is less processor intensive and is referred to herein as the "efficient framing protocol." FIG. **15** illustrates the process and protocol **2000** for formation of a framing layer packet **2016** from IP layer packets **2002**, integrity layer packets, and packing layer packets. The framing layer processing **2000** packs variable length packets received from an upper layer, such as the IP Layer, into fixed length packets **2016** and passes the resulting framing layer packets **2016** to the lower layer, i.e., the physical layer (not shown). The framing layer allows the receiver to determine upper layer packet boundaries and validate the upper layer packet integrity.

As illustrated, process **2000** includes several sub-layers of processing, including an integrity layer and a packing layer. The integrity layer forms an integrity layer payload portion **2006** from the IP layer packet **2002** and appends a trailer **2008**. In one embodiment, the integrity layer payload portion **2006** includes the IP layer packet **2002**; however, alternate embodiments may include a portion of the IP layer packet **2002** or multiple IP layer packets **2002**, or any combination thereof. The trailer **2008** may be the integrity checking mechanism.

The integrity layer appends an integrity check field or trailer **2008** to each IP layer packet **2002**, i.e. packets received from the upper layer which in this case is the IP layer. The integrity layer then passes the resulting integrity layer packets **2006**, **2008** to a lower layer, which in this case is the packing layer. The packets are further processed to form the framing layer packets **2016** and transmitted via the physical layer. At the receiver, packets are received via the physical layer and provided to the higher layers. The integrity layer at the receiver processes the integrity checking mechanism, i.e., trailer, and thus allows the receiver to validate the integrity of packets received from the lower layer before passing them to the upper layer. The format of the integrity layer is illustrated in FIG. **16**, discussed hereinbelow.

Continuing with FIG. **15**, the integrity layer passes the integrity layer packets **2006**, **2008**, to the packing layer for

formation into packing layer packets. The packing layer forms a packet having at least one packing header, or pack header **2010**, at least one packing payload, or pack payload **2012**, and a pad **2014**. The illustrated embodiment includes multiple pack payloads **2012**, each having an associated pack header **2010**. Alternate embodiments may incorporate any number of pack payloads **2012** and pack headers **2010**. From the packing layer, process **2000** then generates a framing layer packet **2016** for provision to the physical layer (not shown).

The packing layer packs variable length packets received from the upper layer (e.g., the integrity layer) into fixed length packing layer packets **2016** and passes the resulting packing layer packets **2016** to a lower layer (e.g., the physical layer). The packing layer allows the receiver to determine upper layer packet boundaries.

FIG. **16** illustrates the format **2050** of the integrity layer packet (packet **2006**, **2008** of FIG. **15**). As illustrated the format **2050** includes two portions: payload field **2052** and Frame Check Sequence (FCS) field **2054**. The payload portion **2052** is a variable length field that contains the octets of exactly one upper layer packet. The FCS portion **2056** is a 32-bit field that contains the FCS for the payload. The FCS is a 32-bit CRC calculated over the payload field. Alternate embodiments may implement other error checking mechanisms.

FIG. **17** illustrates the format **2060** of a packing layer packet according to one embodiment. The format **2060** four fields: continue, length, payload, and pad. The continue field **2062** and the length field **2064** make up a header portion. The continue field **2062** is 1-bit field that indicates whether a corresponding payload field **2066** is the start or continuation of an upper layer packet. Alternate embodiments may implement any number of bits having significance with respect to the payload field **2066**. In the embodiment illustrated in FIG. **17**, when the continue field is set, the corresponding payload field is a continuation of an upper layer packet. Otherwise, the subsequent payload field is the start of an upper layer packet. In this way, each of the pack payloads **2012** (FIG. **15**) may include an entire IP layer packet **2002** (or integrity layer payload **2006**), a portion of an IP layer packet **2006**, multiple IP layer packets **2002**. According to an alternate embodiment, the continue field **2062** is not included in the packing layer format **2060**, wherein if a previous framing layer packet is discarded before reaching the receiver's framing layer, the receiver may use integrity layer processing to determine the start or continuation status of an integrity layer packet. Such an embodiment, however, places an additional processing burden on the integrity layer and expands the integrity checking processing. Note also, that in one embodiment the continue field **2062** is a single bit, wherein the significance of the bit corresponds to the polarity of the bit. Alternate embodiments may have alternate polarity, or as stated hereinabove, may implement a combination of bits to provide additional information, such as a sequence number, etc.

Continuing with FIG. **17**, the header portion further includes a length field **2064**. In one embodiment, the length field **2064** is 15-bit field that indicates the number of octets from the first octet in the corresponding payload field **2066** to the last octet in the upper layer packet contained in the subsequent payload field. The payload field **2066** is a variable length field that contains octets from a single integrity layer packet **2006**, **2008** (FIG. **15**). The number of octets in payload field **2066** is either the length of the octets or the number of octets from the start of the payload field **2006** to the end of the packing layer packet **2016**, whichever is less. The pad field **2068** is a variable length field that contains sufficient bits to maintain the size of a packing layer packet **2016** to the size of the lower layer payload supported by the physical layer. The constitution of the pad field **2068** reflects a predetermined recognizable pattern, such as all zero octets, etc. The transmitter fills the pad field **2068**, which is received and ignored or discarded by the receiver.

Access Network

A general access network topology for a system **1000** is illustrated in FIG. **13** having a CS **1002**, a PDSN **1004**, and two PCF: PCF**1** **1006** and PCF**2** **1008**. FIG. **13** includes datagrams specifying the transmissions from each of the infrastructure elements illustrated in the system **1000**. As illustrated, the CS **1002** prepares an IP packet of information and transmits the packet in at least one frame, having a payload and inner header, H**1**. The inner header has source and destination information, wherein the source identifies the CS **1002** and the destination identifies a subscription group. The CS **1002** transmits the frame to the PDSN **1004**, which maps the destination subscription group to individual subscribers in a set of active users.

The PDSN **1004** determines the number of individual users in the active set that are in the destination subscription group and duplicates the frame received from the CS **1002** for each of those users. The PDSN **1004** determines the PCF(s) corresponding to each of the users in the subscription group. The PDSN **1004** then appends an outer header, H**2**, to each of the prepared frames, wherein H**2** identifies a PCF. The PDSN **1004** then transmits the frames to the PCF(s). The transmission from the PDSN **1004** includes the original payload, the header H**1**, and the Header H**2**. As illustrated, the PDSN **1004** sends N transmission frames to PCF**1** **1006** and sends M transmission frames to PCF**2** **1008**. The N transmission frames correspond to N users in the subscription group serviced via PCF**1** **1006** and the M transmission frames correspond to M users in the subscription group serviced via PCF**2** **1008**. In this scenario, the PDSN **1004** duplicates received frames any number of times for transmission to the corresponding subscribers.

FIG. **14** illustrates an exemplary embodiment of a system **1020** having a CS **1022** communicating with PCF**1** **1026** and PCF**2** **1028** via PDSN **1024**. As illustrated, the CS **1022** prepares an IP packet of information and transmits the packet in at least one frame, having a payload and inner header, H**1**. The inner header has source and destination information, wherein the source identifies the CS **1022** and the destination identifies a subscription group. The CS **1022** transmits the frame to the PDSN **1024**, wherein the PDSN **1024** appends an outer header, H**2**, wherein H**2** routes the frame to at least one PCF. The PDSN **1024** then transmits the frames to the PCF(s). The transmission from the PDSN **1024** includes the original payload, the header H**1**, and the Header H**2**. As illustrated, the PDSN **1024** sends one transmission frame to PCF**1** **1026** and sends one transmission frame to PCF**2** **1028**. The PCF**1** **1026** sends one transmission frame to the N users in the subscription group. The PCF**2** **1028** sends one transmission frame to the M users in the subscription group.

According to an exemplary embodiment, the broadcast CS sends IP packets containing encrypted broadcast content to a multicast group identified by a class-D multicast IP address. This address is used in the destination address field of the IP packets. A given PDSN **1024** participates in multicast routing of these packets. After header compression, the PDSN **1024** places each packet in an HDLC frame for transmission. The HDLC frame is encapsulated by a Generic Routing Encapsulation (GRE) packet. The key field of the GRE packet header uses a special value to indicate a broadcast bearer connection. The GRE packet is appended with the 20-byte IP packet

header having a source address field identifying the IP address of the PDSN **1024**, and destination address field uses a class-D multicast IP address. It is recommended that this multicast IP address is different from the one used by the broadcast CS. The system **1020** configures at least one multicast routing table of the respective PCFs and PDSNs. The packets delivered in the broadcast connection are provided in sequence; in the exemplary embodiment the GRE sequencing feature is enabled. Duplication of the IP multicast packets is done in multicast-capable routers.

In an exemplary embodiment, each PCF is further coupled to a BSC (not shown), wherein a given BSC may duplicate the packets and send them to another BSC. The chaining of BSCs yields better soft handoff performance. The anchoring BSC yields better soft handoff performance. The anchoring BSC duplicates the transmission frame and sends it with the same time-stamp to its adjacent BSCs. The time-stamp information is critical to the soft handoff operation as the mobile station receives transmission frames from different BSCs.

Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

The various illustrative logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

What is claimed is:

1. A method for framing packets in a wireless transmission system supporting broadcast transmissions, the method comprising:

generating a portion of an Internet Protocol (IP) packet for transmission;

appending a start of frame indicator to the portion of the IP packet;

applying an error checking mechanism to the portion of the IP packet not including a protocol field to identify a payload type;

preparing a frame for transmission, having the start of frame indicator, the portion of the IP packet, and the error checking mechanism; and

transmitting the frame without the protocol field.

2. The method as in claim **1**, wherein the start of frame indicator is a predetermined sequence of bits, the method further comprising:

if the portion of the IP packet contains the predetermined sequence of bits, inserting a classifier into the portion of the IP packet.

3. The method as in claim **2**, wherein the classifier corresponds to an escape character.

4. The method as in claim **1**, wherein the error checking mechanism is a frame check sequence.

5. A method for receiving framed packets in a wireless transmission system supporting broadcast transmissions, the method comprising:

receiving a frame of a packet transmission wherein the frame contains a payload portion of an Internet Protocol (IP) packet and does not include a protocol field to identify a payload type, the frame having a start of frame portion, a payload portion, and an error check portion, the frame not including the protocol field;

identifying the frame as a start frame in the packet transmission;

verifying the frame using the error check portion of the frame; and

processing the payload portion of the frame.

6. The method as in claim **5**, wherein if the start of frame indicator is a predetermined sequence of bits, and wherein if the payload portion contains the predetermined sequence of bits, the payload portion further includes a classifier to identify the predetermined sequence of bits in the payload.

7. The method as in claim **6**, wherein the classifier defines an escape character.

8. The method as in claim **6**, further comprising:

identifying the classifier in the payload not including protocol information to identify a payload type; and

processing the payload without the classifier.

9. The method as in claim 5, wherein the error check portion is a frame check sequence.

10. An apparatus for framing packets in a wireless transmission system supporting broadcast transmissions, the apparatus comprising:

means for generating a portion of an Internet Protocol (IP) packet for transmission;

means for appending a start of frame indicator to the portion of the IP packet;

means for applying an error checking mechanism to the portion of the IP packet;

means for preparing a frame for transmission, having the start of frame indicator, the portion of the IP packet and the error checking mechanism and not including a protocol field to identify a payload type; and

means for transmitting the frame without the protocol field.

11. An apparatus for receiving framed packets in a wireless transmission system supporting broadcast transmissions, the apparatus comprising:

means for receiving a frame of a packet transmission wherein the frame contains a payload portion of an Internet Protocol (IP) packet and does not include a protocol field to identify a payload type, the frame having a start of frame portion, a payload portion, and an error check portion, the frame not including the protocol field;

means for identifying the frame as a start frame in the packet transmission;

means for verifying the frame using the error check portion of the frame; and

means for processing the payload portion of the frame.

12. A non-transitory storage medium encoded with executable instructions for framing packets in a wireless transmission system supporting broadcast transmissions, the instructions comprising:

a first set of instructions for generating a portion of an Internet Protocol (IP) packet for transmission;

a second set of instructions for appending a start of frame indicator to the portion of the IP packet;

a third set of instructions for applying an error checking mechanism to the portion of the IP packet;

a fourth set of instructions for preparing a frame for transmission, having the start of frame indicator, the portion of the IP packet and the error checking mechanism and not including a protocol field to identify a payload type; and

a fifth set of instructions for transmitting the frame without the protocol field.

13. A non-transitory storage medium encoded with executable instructions for receiving framed packets in a wireless transmission system supporting broadcast transmissions, the instructions comprising:

a first set of instructions for receiving a frame of a packet transmission wherein the frame contains a payload portion of an Internet Protocol (IP) packet and does not include a protocol field to identify a payload type; the frame having a start of frame portion, a payload portion, and an error check portion, the frame not including the protocol field;

a second set of instructions for identifying the frame as a start frame in the packet transmission;

a third set of instructions for verifying the frame using the error check portion of the frame; and

a fourth set of instructions for processing the payload portion of the frame.

14. An apparatus comprising:

a memory; and

a processor for executing a set of instructions stored in the memory, the set of instructions for:

generating a portion of an Internet Protocol (IP) packet for transmission;

appending a start of frame indicator to the portion of the IP packet;

applying an error checking mechanism to the portion of the IP packet not including a protocol field to identify a payload type;

preparing a frame for transmission, having the start of frame indicator, the portion of the IP packet, and the error checking mechanism; and

transmitting the frame without the protocol field.

15. The apparatus of claim 14, wherein the start of frame indicator is a predetermined sequence of bits and wherein the processor is futher for executing instructions for:

if the portion of the IP packet contains the predetermined sequence of bits, inserting a classifier into the portion of the IP packet.

16. The apparatus of claim 15, wherein the classifier corresponds to an escape character.

17. The apparatus of claim 14, wherein the error checking mechanism is a frame check sequence.

18. An apparatus for receiving framed packets in a wireless transmission system supporting broadcast transmissions, the apparatus comprising:

a memory; and

a processor for executing a set of instructions stored in the memory, the set of instructions for:

receiving a frame of a packet transmission wherein the frame contains a payload portion of an Internet Protocol (IP) packet and does not include a protocol field to identify a payload type, the frame having a start of frame portion, a payload portion, and an error check portion, the frame not including the protocol field;

identifying the frame as a start frame in the packet transmission;

verifying the frame using the error check portion of the frame; and

processing the payload portion of the frame.

19. The apparatus of claim 18, wherein if the start of frame indicator is a predetermined sequence of bits, and wherein if the payload portion contains the predetermined sequence of bits, the payload portion further includes a classifier to identify the predetermined sequence of bits in the payload.

20. The apparatus of claim 19, wherein the classifier defines an escape character.

21. The apparatus of claim 19, wherein the processor is further for executing instructions for:

identifying the classifier in the payload not including protocol information to identify a payload type; and

processing the payload without the classifier.

22. The apparatus of claim 18, wherein the error check portion is a frame check sequence.

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